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STRUCTURE AND PROBLEMS OF NIGERIA'S ANIMAL FEED INDUSTRY

Information paper*

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* The views expressed in this document are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO). This document has not been edited.

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A B S T R A C T

Notwithstanding Nigeria's sizeable livestock population (cattle, goats, sheep, pigs and domestic and exotic poultry), the country is still deficient in animal protein consumption. In fact, the average daily intake per capita amounts to only about 38 per cent of the minimum value recommended by the Food and Agriculture Organization (FAO) for the developing countries. As a consequence, such protein-deficiency-related diseases as kwashiorkor still persist and may in fact be intensifying, particularly among children and the rural and urban poor.

Although poultry provides only about 10 per cent of the national meat consumption, it is the most modern and technically developed element of livestock husbandry. Accordingly, 95 per cent of the compound animal feed production is targeted at the poultry industry. At present, there are about 10 large-scale feed mills, i.e. 10 tons/hour and over, and fewer than 100 small- and medium-scale mills, most of which are located on poultry farms and are rated at under 2.5 tons/hour. The total feed output declined from about 500,000 tons in 1985 to under 200,000 tons in 1991.

Among the constraints militating against increased output are the inadequate availability of raw materials from both domestic and foreign sources, the industry's traditional resistance to utilization of non-conventional alternative ingredients, the inability to recover and process agricultural and industrial wastes for use in feed manufacturing, and the national over-dependence on imports for machinery, equipment and spare parts.

Several local alternative ingredients have been identified. Among these are sorghum, millet, cassava, yam, oil palm products, periwinkle shells, rubber seed, sugar cane tops, molasses and elephant grass. However, appropriate processing technologies and equipment need to be developed for rendering many of them suitable for use in commercial feed formulation.

For sustained long-term development of the industry, several specific strategies and actions are recommended. These include:

- Establishment of a macro-economic policy environment conducive to stimulating private sector and small-scale investments in both poultry farming and animal feed manufacturing;
- Expanded production of the key crops and ingredients consumed by feed mills;
- Development (through research and plant breeding) of specialized and end-user-targeted hybrids of feed mill crops to minimize the competition with human and other industrial consumers;

- **Enhanced recovery, processing and utilization of non-conventional agricultural and industry by-products;**

- **Development of the local capital goods and engineering industries for the supply of machinery, equipment, spare parts and maintenance services; and**

- **Establishment of strategic grain reserves to serve as a buffer against production fluctuations.**

I. THE NIGERIAN LIVESTOCK SUB-SECTOR

1. The economic importance of the livestock sub-sector may be gauged from the fact that, according to the Central Bank of Nigeria, it contributed about 5.9 per cent of the Gross Domestic Product (GDP) in 1989, representing over 20 per cent of the agricultural GDP. Furthermore, the sub-sector traditionally provides employment and income to a substantial proportion of the rural population.

2. Its economic importance notwithstanding, the sub-sector is still unable to satisfy the minimal recommended animal protein requirement of the average Nigerian. For instance, whereas the British Medical Association's recommended minimum protein intake per day capita is 34 grams, and the Food and Agriculture Organization (FAO) of the United Nations recommends a minimum intake of 20 grams/capita/day for the developing countries, the figure for the average Nigerian stood at only 7.6 grams in 1985, equivalent to 38 per cent of the FAO recommendation. The economic difficulties engendered by Nigeria's Structural Adjustment Programme (SAP) have probably driven that figure further downwards.

3. Nigeria's livestock population consists largely of cattle, sheep, goats, pigs and poultry. A 1990 census by the Federal Department of Livestock and Pest Control Services yielded the following population estimates:

Cattle	-	13.9 million
Goats	-	34.5 million
Sheep	-	22.1 million
Pigs	-	3.4 million
Indigenous poultry	-	102.8 million
Exotic poultry species	-	46-49 million

In terms of meat supply, however, cattle contribute over 50 per cent of the national consumption. Sheep and goats account for about 35 per cent while poultry contributes only 10 per cent.

4. The constraints militating against optimal performances by the Nigerian livestock sub-sector can be categorized as technical, sociological, economic and institutional.[1] The technical constraints are those conventionally associated with traditional pastoralism and the prevalence of the culture of subsistence animal husbandry. These give rise to inadequate nutrition, diseases, high mortality and poor genetic potential of indigenous animal species. The sociological constraints derive from ancient cultural values associated with livestock. These tend to impede the adoption of new technologies and production practices. The economic problems are manifested in the form of limited or

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[1] S. Tunji Titilola, "The Nigerian Livestock Sub-Sector and Prospects for the Future," Proceedings of the Workshop on the Proposed Livestock Sub-Sector Review, LIMECU, April 1992.

inaccessible farm capital and credit, inadequate infrastructure and poor pricing of livestock products. As for the institutional constraints, these are in the form of poor extension services, in inadequate human capacity building facilities and inefficient marketing systems.

5. Of the various components of the livestock sub-sector, the poultry industry experienced the fastest growth and dynamism in the last twenty-five years. Introduced commercially in the late-1990s, modern poultry farming experienced only a modest development until about 1974. This was followed by an impressive boom between 1974 and 1983. During this period, the domestic supply of poultry meat from exotic species alone increased from 8.1 per cent in 1977 to 11.4 per cent in 1987. However, since 1987, the industry has been in relative decline. About 80 per cent of the modern poultry farms in operation in 1983 have since closed down, and no new projects are being brought on-stream at present.

6. Among the factors contributing to the current depressed status of the industry are:

- The limited availability and concomitant high cost of poultry feeds;
- The high level of dependence on imports for poultry equipment, spare parts and drugs; for instance, whereas in the early-1980s, it cost about three Naira (N3) per bird-space of cage, the corresponding early-1992 price was over N70.
- Poorly developed infrastructure, particularly water and electricity supplies in the rural areas where poultry farms are located in order to avoid pollution of the urban environment; as such, most poultry investors must, in addition to conventional productive facilities, invest in such apparently extraneous items as access roads, electricity generators and water boreholes.
- Bad poultry management attributable to the general lack of appreciation of poultry husbandry as a specialized discipline.

II. THE ANIMAL FEED INDUSTRY

7. A survey by the Nigerian Institute of Social and Economic Research (NISER) indicated that there were about 440 feed mills in Nigeria in 1986, with an aggregate production capacity of about 1,500 tons of feed per hour.[2] Of these, about 95 per cent could be categorised as small-scale in the sense that their rated

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[2] M.S. Igben, V.A. Adeyeye, S.O. Akande and P.A. Okuneye, "The Raw Materials Crisis in Agro-Allied Industries in Nigeria: Magnitude, Prospects and Strategies," NISER Technical Report, 1987.

capacities were less than 10 tons per hour. In fact, 60 per cent of the total number had individual capacities well under 2.5 tons per hour.

8. In terms of installed capacity utilization, the trend during the 1975 to 1988 period was as follows:

Year	Installed Capacity	Utilised Capacity
1975	500,000 tons	250,000 tons (50%)
1978	680,000 tons	350,000 tons (51.5%)
1985	1,000,000 tons	500,000 tons (50%)
1987	850,000 tons	310,000 tons (36.5%)
1988	650,000 tons	169,000 tons (26%)

The 1992 effective installed capacity and capacity utilisation are believed to be even lower than the 1988 figures.

9. The above figures should be assessed against the estimated demand figures of 850,000 tons and 825,000 tons for 1989 and 1991 respectively, in order to appreciate the severity of the supply short-fall as well as the astronomical dimensions of the escalation in feed prices in the last eight years. What is even more disturbing is that, in order to meet the animal protein needs of the Nigerian population in the year 2000, the annual output of livestock feeds would have to be in range of 2.6 to 3.5 million tons.

10. The demand pattern for compound livestock feeds is currently estimated to be as follows:

Poultry	-	95%
Pigs	-	3%
Cattle	-	1.5%
Others	-	0.5%

11. Non-availability of feed ingredients is the single most important factor responsible for the industry's under-utilization of installed capacity. This has been further exacerbated by the extreme conservatism of the local industry which has traditionally depended on only a limited choice of well-tested raw materials such as maize, groundnut cake and fish meal, and has consistently shied away from utilising alternative local ingredients.

12. Furthermore, certain government policies and measures introduced as components of the Structural Adjustment Programme (SAP) have had the adverse effect of restricting raw materials availability from both local sources and imports. Insofar as domestic production is concerned, the lifting of controls on producer prices and the abolition of the Commodity Marketing Boards in 1986 resulted in a sudden drastic price escalation to which the farmers reacted by substantially increasing production in the following year. With the resultant surplus production,

prices plummeted. Subsequent years have witnessed this cycle of surplus-followed-by-deficit, as well as severe price fluctuations for such grains as maize, soya bean and groundnut. With respect to importation of feed ingredients the Government in 1986, in an effort to improve the country's balance-of-payments position and stem the massive drainage of foreign exchange, imposed a ban on the importation of most grains, including wheat, maize, rice and barley malt. It had been hoped that this would stimulate local production and ultimately stabilize prices. It is doubtful whether any of these objectives have been achieved. In fact, the ban on wheat importation which encouraged massive smuggling from other countries in the sub-region, has recently been lifted. In the meantime, local production hardly increased and the prices may never again return to their pre-SAP levels. The severity of the price escalation for feed ingredients can be seen from the following:

Ingredients	Pre-SAP Price (per ton)	April 1992 Price (per ton)
Local maize	N400 - N500	N 3,200
Soya bean meal	N 450	N 4,200
Groundnut meal	N 550	N 3,600
Bone meal	N 200	N 800
Imported fish meal	N 800	N 3,000
Imported lysine	N10,000	N62,000

The upward price spiral was further fuelled by the competition for grains between human consumers, the feed mills, breweries, flour mills and pharmaceutical manufacturers. This was a competition which the feed mills were ill-equipped to win since they do not normally enjoy the quicker turnovers, consumer loyalty, capacity to pass on cost increases, high return-on-investment and greater price stability characteristic of the other industries.

13. The feed mills might have been able to weather these cost escalations had they been more favourably disposed towards utilization of more readily available alternative ingredients. For instance, whereas maize is used at levels of 40 - 50 per cent in Nigerian livestock feeds, research has demonstrated that poultry formulations containing only 20 per cent maize could be effective and economically efficient. The long-term consequences of such a modification are even more impressive and far-reaching. The maize requirement of the livestock feed industry in the year 2000 could thus be reduced by 60 per cent from 5.3 million tons to only 2.1 million tons.

14. In addition to reducing the maize utilization level, such local crops as sorghum, millet, cassava and potato chips, rice polishing waste, maize offal and dried brewers' grain could be readily substituted for maize in poultry feeds without a severe loss of nutritional effectiveness. The substitution of cassava for maize is of particular interest as Nigeria is the world's largest producer at about 13 million tons per year, of which about 700,000 tons is potentially available to the livestock feed industry.

15. Other possible substitutes that would relieve the demand pressure on maize, most of which is for human consumption, are maize-cum-full fat soya bean or poultry offal meal in place of fish meal, and cotton and sunflower seed cake as a replacement for soya bean meal. With respect to cotton seed cake, indications are that the problems of gossypol toxicity and mycotoxin retention in animal tissues may be unduly exaggerated.

16. As stated previously, feed milling in Nigeria is virtually synonymous with the production of poultry feeds. As such, most small-scale feed mills are located on poultry farms and have capacities in the 0.5 to 1.0 ton per hour range. This size is ideal for a 20,000-bird poultry farm. The feed manufacturing technology involved is relatively simple and straight-forward, consisting merely of grain milling, mixing in of appropriate concentrates and packaging, usually in bags.

17. A typical 0.5 ton per hour mill would comprise the following principal elements:

- hammer mill
- stone trap and magnet for removing impurities from the hammer mill
- intake hopper with grate to control flow
- vertical mixer
- dust sack
- bagging-off chute.

18. The hopper is generally mounted at such an angle as to facilitate the free flow of the grain. A sliding gate at the neck of the hopper controls the rate at which the grain enters the mill. Generally, a screen with 3.0 millimetre holes is employed and the milled grain is usually pneumatically discharged into the top of the mixer. An auger delivers the concentrate which has been loaded by the operator into the mixer where it is mixed with the grain and delivered into a bag chute. Most of the feed mills are fitted with dust bags and the recovered dust is generally recycled.

19. Many of the equipment elements of a small feed mill of the type and size described above can be locally fabricated. The working parts of the hammer mill, the screen and the hammers are easy to replace from local fabricators. In fact, the following institutions have developed more or less proprietary designs of small-scale feed mills that have been fabricated, installed and are satisfactorily operating in several poultry farms around the country:

- Projects Development Institute (PRODA), Enugu
- Rural Agro-Industrial Development Scheme (RAIDS), Ibadan
- The Directorate of Food, Roads and Rural Infrastructure (DFRRI), Lagos
- The African Regional Centre for Engineering Design and Manufacturing (ARCEDEM), Ibadan
- The Federal Institute of Industrial Research, Oshodi (FIIRO), Lagos

- The Faculties of Engineering and Technology of several Universities and Polytechnics, including the University of Ibadan, the Obafemi Awolowo University, Ile-Ife, the University of Nigeria, Nsukka and the Ahmadu Bello University, Zaria.

20. Insofar as international trade in animal feeds is concerned, there does not now appear to be any significant legal regional or sub-regional activity involving Nigeria, although there may be some smuggling to and from the neighbouring countries. However, given the fact that Nigeria possesses vast, albeit largely untapped potentials for local production of many of the key feed mill ingredients such as maize, soya bean, groundnuts and sorghum, and given its national installed grain milling capacity of about 4.2 million tons per year from 22 large-scale mills, there is reason for optimism regarding the eventual evolution of some significant trade in animal feeds within the Economic Community of West African States'(ECOWAS) sub-region. This is a subject that should attract the interest of Nigerian and ECOWAS policy-makers at this time of increasing emphasis on the promotion of regional trade in non-oil manufactured exports.

21. In summary, the major constraints militating against the growth of the livestock feed industry in Nigeria include:

- Irregular and inadequate supplies of raw materials;
- High and unstable prices of feed ingredients;
- Inability to recover, process and utilize local agricultural and industrial by-products and wastes;
- Reluctance of the industry to utilize alternative ingredients;
- Dearth of information on the composition and processing requirements for locally-available ingredients, by-products and wastes;
- Inadequate technical and managerial expertise;
- Inadequate and inefficient infrastructure and utilities;
- Over-dependence on importation for machinery, equipment and spare parts due, in large measure, to the underdeveloped status of the local capital goods and engineering industries; and
- Instability and unpredictability of government policies.

III. ALTERNATIVE FEED INGREDIENTS

22. Recognizing the need to reduce the industry's over-dependence on scarce cereals and to minimize or, if possible, eliminate such expensive imported feed components as fish, bone and meat meals, the current Government-motivated policy is aimed at exploiting all locally-available alternative feed ingredients. Alternative feed formulations would desirably contain such locally-available by-products as brewers' grains, dried brewers' yeast, palm oil sludge and molasses from sugar manufacturing. Potential alternatives to fish meal which, in any event, could be locally-produced from trawling discards, small-sized clupeids and fish offal, include poultry offal meal, blood meal and sterilized and dried poultry

manure. As for the minerals, locally-available periwinkle shells and limestone could be substituted for such conventional ingredients as bone meal and oyster shells.

23. In the wake of the collapse in the late-1980s of the poultry and feed industries, the Government in 1989, set up a Presidential Task Force on Alternative Formulations of Livestock Feeds.[3] The membership of the Task Force was drawn from academia, relevant government ministries and agencies, the livestock and feed manufacturing industries, and animal and food research institutions. Its broad mandate was to analyze the raw material problems of the animal feeds industry and to identify, test and recommend alternative ingredients for use in feed formulation, giving substantial weight to maximum utilisation of local ingredients. In discharging this mandate, the Task Force conducted elaborate surveys, chemical analyses of identified potential alternatives, and formulated and tested feeds with poultry, pigs, rabbits, cattle, sheep and goats.

24. On the strength of these analyses, the following documents were produced and published for dissemination to interested feed manufacturers, farmers, investors and researchers:

- Feed compositions, feed resources utilisation and economics of use of non-conventional and industrial by-products;
- Validation results on nutrient requirements of various classes of livestock and fish;
- Processing technologies and fabrication of small and medium-scale equipment for farm products;
- A compendium of 2,500 alternative diets for non-ruminants, 40 alternative diets for dry-season supplementary feeding of ruminants, and 20 alternative simplified diets for broilers, layers and fish.

25. More specifically, the Task Force identified the following local feed resources:

i. Cereals and by-products
Maize; sorghum; millet; rice; wheat; dried brewers' grain (DBG); bran; husk and offal.

ii. Carbohydrate ingredients
Cassava; yam; cocoyam and potatoes.

iii. Mineral sources
Periwinkle and oyster shells; limestone.

iv. Oilseeds and by-products
Beniseed; sunflower; oil palm products; cashew; cottonseed; groundnut; soya bean; rubber seed; melon seed and cowpea.

[3] Report of the Presidential Task Force on Alternative Formulations of Livestock Feeds, October 1992.

v. Protein sources
Shrimp heads; poultry offal; animal blood.

vi. Roughage materials
Sugar cane tops; elephant grass; sweet potato vines.

26. Recommendations were also made for specific measures to be taken by both the Government and the industry for increased utilization of the identified ingredients which should ultimately lead to lower prices for animal feeds. For the industry, the recommendations included a greater role in ingredients production. This would not necessarily involve direct production, but could be through such indirect measures as promoting out-grower schemes for the major feed crops, supplying credit, inputs and extension services to small- and medium-scale farmers, and shifting emphasis from finished feed production to high-quality feed concentrates. The Government, for its part, would implement programmes for increased crop production, and would set up a chain of Livestock Feeds Monitoring, Research and Development Centres for feed quality control and monitoring, screening of feed ingredients, and enforcement of standards in feed formulation.

IV. RECOMMENDED STRATEGIES FOR SUSTAINED DEVELOPMENT

27. As is evident from the foregoing, the structure and constraints of the Nigerian animal feeds industry are such as can only be effectively addressed with a comprehensive and multi-dimensional package of policies and actions. This would necessarily require the involvement of the Government, the feeds manufacturing industry and researchers. The following specific recommendations point to the types of action and programme required for future sustained development of the sub-sector:

(a) Creation of a favourable macro-economic policy environment

The macro-economic policies that most directly affect the livestock and animal feed industries and which could be fine-tuned to harmonize with increased production and efficiency, are fiscal policy (i.e. public expenditure, investment policies and taxation), monetary policy (i.e. interest rate and credit guidelines), exchange rate policy, external trade policy and public sector reform which could conceivably involve such measures as commercialization and privatization of erstwhile public enterprises.

(b) Production expansion of key ingredients

Since farmers and other investors base their behaviour on the potential returns on their investment and labour, any programme for expanded agricultural production should be rooted on a realistic appraisal of the factors that determine this behaviour. In this connection, past Government-driven production expansion programmes such as the Accelerated Food Production Programme, Operation Feed-the-Nation, the Green Revolution and the Accelerated Wheat Production Programme, largely failed because they were ill-planned and ill-

supported with the necessary resources, politically motivated and often not founded on the tenets of the market. Future programmes should learn from the experience of the past and should make full use of existing institutions such as the various state Agricultural Development Projects (ADPs), the River Basin Development Authorities (RBDAs), the National Agricultural Land Development Agency (NALDA) and similar organizations.

(c) Development of specialized and user-targeted hybrids of key crops

This is significant in view of the fact that the acknowledged limited outputs of maize, sorghum, soya beans and millet must be competed for by human and industrial consumers. There is, for instance, no genetic differentiation between maize for human consumption and maize for livestock feed mills. There is therefore a need for expanded research aimed at developing hybrid species of the various crops for targeted end-use markets. This would minimize competition and moderate prices.

(d) Enhanced utilization of non-conventional domestic feed ingredients

These have already been identified. Unfortunately, virtually all of them require some measure of pre-processing, either at the source or at the point of use. This calls for the development of appropriate processing technologies and equipment.

(e) Development of the local capital goods and engineering industries

The weakness of these sub-sectors has been the bane of the Nigerian industrial sector in general, contributing significantly to the gross under-utilization of installed manufacturing capacity. Because machinery, spare parts and technology cannot be readily sourced locally, there is an over-dependence on importation. The sustainable solution lies in fostering the development of the local engineering and capital goods industries, and in technical manpower development to meet the needs of industry, including animal feed.

(f) Strategic grains reserve

Given the cyclical nature of production of many of the key crops consumed by feed millers, there may be advantages in establishing a National Strategic Grains Reserve as a measure for buffering temporary shortages and moderating price fluctuations while ensuring reliability of supplies to industrial end-users such as feed mills.

(g) Local production of feed supplements

This is crucial if the industry is to achieve a greater measure of self-reliance and enhanced value-added in manufacturing. What is more, the drastic price increases on imported inputs arising from the SAP-dictated devaluation of the Naira would have been ameliorated had there been a credible local supplements manufacturing industry based largely on local raw materials.

(h) By-products recovery and processing

As pointed out previously, many agricultural and industrial by-products that could be consumed in animal feed production are currently wasted. Measures are required for ensuring their recovery and pre-processing for use. For instance, animal blood and bone are routinely wasted at the local abattoirs and slaughter-slabs while, ironically, costly blood and bone meal are imported for feed production.

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